

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
*SOUTH DAKOTA SUPPLEMENTS ITALICIZED***

GRASSED WATERWAY

(ac.)
CODE 412

DEFINITION

A natural or constructed channel that is shaped or graded to required dimensions and established with suitable vegetation.

PURPOSES

This practice may be applied as part of a conservation management system to support one or more of the following purposes:

To convey runoff from terraces, diversions, or other water concentrations without causing erosion or flooding;

To reduce gully erosion;

To protect/improve water quality.

CONDITIONS WHERE PRACTICE APPLIES

In areas where added water conveyance capacity and vegetative protection are needed to control erosion resulting from concentrated runoff and where such control can be achieved by using this practice alone or combined with other conservation practices.

This standard applies to waterways having drainage areas of two square miles or less in the South Dakota Technical Guide (SDTG) Eastern Area or one square mile or less in the remainder of the state. When the above drainage area sizes are exceeded, design criteria regarding waterway stability and capacity must meet requirements of the standard for Open Channel (582).

This practice does not apply where the present watercourse is not seriously eroding.

CRITERIA

Laws and Regulations. *This practice must conform to all federal, state, and local laws and regulations. Laws and regulations of particular concern include those involving water rights, land use, pollution control, property easements, wetlands, preservation of cultural resources, and endangered species.*

Capacity. The minimum capacity shall be that required to convey the peak runoff expected from a storm of 10-year frequency, 24-hour duration. When the waterway slope is less than 1 percent, out-of-bank flow may be permitted if such flow will not cause excessive erosion. The minimum in such cases shall be the capacity required to remove the water before crops are damaged.

Velocity. Design velocities shall not exceed those obtained by using the procedures, "n" values, and recommendations in the NRCS Engineering Field Handbook (EFH) Part 650, Chapter 7, or Agricultural Research Service (ARS) Agricultural Handbook 667, Stability Design of Grass-lined Open Channels.

Design velocities for waterways or outlets must be based on "D" (low vegetal) retardance and must not exceed permissible velocities as described in Table 1.

**Table 1. Maximum Design Velocities
(feet/second)**

Vegetation, Slope	Easily Eroded Soils ($K > 0.35$)	Erosion Resistant Soils ($K < 0.35$)
<i>Poor veg. Slope 0-5%</i>	2.5	3.5
<i>Good veg. Slope 0-5%</i>	5.0	7.0
<i>Slope > 5%</i>	3.5	5.0

Conservation practice standards are reviewed periodically and updated if needed. The current version of this standard is posted on our website at www.sd.nrcs.usda.gov or may be obtained at your local Natural Resources Conservation Service.

Where site conditions warrant the use of a structural lining, the design shall be in accordance with Natural Resources Conservation Service (NRCS) conservation practice standard, Lined Waterway or Outlet (468).

Width. *Waterways and outlets shall be either parabolic or trapezoidal in cross section. The bottom width of trapezoidal waterways or outlets shall not exceed 100 feet unless multiple or divided waterways or other means are provided to prevent meandering of low flows. The minimum width shall be that necessary to carry the designed capacity either at or below designed depth. Waterways, which will be crossed by farm equipment, shall be designed to accommodate the land user's equipment.*

Side Slopes. *Side slopes shall not be steeper than two horizontal to one vertical. They shall be designed to accommodate the equipment anticipated to be used for maintenance and tillage/harvesting that will cross the waterway.*

Depth. *The minimum depth of a waterway that receives water from terraces, diversions, or other tributary channels shall be that required to keep the design water surface elevation at, or below the design water surface elevation in the terrace, diversion, or other tributary channel, at their junction when both are flowing at design depth.*

Freeboard above the designed depth shall be provided when flow must be contained to prevent damage. This freeboard is above the designed depth when the vegetation has the maximum expected retardance.

Drainage. *Subsurface drains, underground outlets, water-tolerant vegetation (reed canary grass, etc.), or other measures to control erosion should be provided in the design for sites having prolonged flows, a high water table, or seepage problems. See NRCS conservation practice standards Subsurface Drains (606), Underground Outlet (620), and Critical Area Planting (342).*

Outlets. *All grassed waterways shall have a stable outlet with adequate capacity to prevent ponding or flooding damages. The outlet can be another vegetated channel, an earthen ditch, a grade-stabilization structure, filter strip or other suitable outlet.*

Vegetative Establishment. *Grassed waterways shall be vegetated according to NRCS conservation practice standard Critical Area Planting, Code 342.*

Mulching shall be done in accordance with standard Mulching (484).

To avoid excessive erosion, waterway and outlet construction must be scheduled to allow seeding immediately after completion of construction. Seeding can only be performed at optimum times of the year as specified under the standard for Critical Area Seeding (342).

Owners and operators should be encouraged to establish Filter Strips (393) adjacent to waterways to improve vegetation quality and waterway durability.

Buffers. *The addition of grass buffers along the sides of the grassed waterway are strongly recommended to reduce sediment deposition and extend the life of the waterway.*

CONSIDERATIONS

Quantity. *Effects on the components of the water budget, especially on volumes and rates of runoff.*

Quality. *Effects on erosion and the movement of sediment, pathogens, and soluble and sediment-attached substance carried by runoff.*

Filtering effects of vegetation on movement of sediment and dissolved and sediment-attached substances.

Short-term and construction-related effects on downstream water resources.

Important wildlife habitat, such as woody cover or wetlands, should be avoided or protected if possible when siting the grassed waterway. If trees and shrubs are incorporated, they should be retained or planted in the periphery of grassed waterways so they do not interfere with hydraulic functions. Mid- or tall bunch grasses and perennial forbs may also be planted along waterway margins to improve wildlife habitat. Waterways with these wildlife features are more beneficial when connecting other habitat types; such as riparian areas, wooded tracts, and wetlands.

Water-tolerant vegetation may be an alternative on some wet sites.

Use irrigation in dry regions or supplemental irrigation as necessary to promote germination and vegetation establishment.

Provide livestock and vehicular crossings as necessary to prevent damage to the waterway and its vegetation.

Establish filter strips *at least 10 feet wide* on each side of the waterway to improve water quality, *and reduce sediment damage to the waterway.*

Add width of appropriate vegetation to the sides of the waterway for wildlife habitat.

PLANS AND SPECIFICATIONS

Plans and specifications for grassed waterways shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose(s).

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be provided to and reviewed with the landowner. The plan shall include the following items and others as appropriate.

A maintenance program shall be established to maintain waterway capacity, vegetative cover, and outlet stability. Vegetation damaged by machinery, herbicides, or erosion must be repaired promptly.

Seeding shall be protected from concentrated flow and grazing until vegetation is established.

Minimize damage to vegetation by excluding livestock whenever possible, especially during wet periods.

Inspect grassed waterways regularly, especially following heavy rains. Damaged areas will be filled, compacted, and seeded immediately. Remove sediment deposits to maintain capacity of grassed waterway.

Landowners should be advised to avoid areas where forbs have been established when applying herbicides. Avoid using waterways as turn-rows during tillage and cultivation operations. Prescribed burning and mowing may be appropriate to enhance wildlife values, but *should* be conducted to avoid peak nesting seasons and reduced winter cover.

Mow or periodically graze vegetation to maintain flow capacity and reduce sediment deposition.

Erosion and/or sediment deposition must not be allowed to divert runoff from entering (and flowing in) the waterway. Waterway and/or adjacent areas should be regraded at 300 foot (or shorter) intervals to force runoff to flow in the waterway.

Control noxious weeds.

Do not use as a field road. Avoid crossing with heavy equipment when wet.

REFERENCES

NRCS Engineering Field Handbook, Part 650 (formerly "Engineering Field Manual"):

Chapter 1, Engineering Surveys

Chapter 2, Estimating Runoff

Chapter 7, Grassed Waterways

ARS Agricultural Handbook 667, Stability Design of Grass-Lined Open Channels

SCS-TP-61, Handbook of Channel Design and Water Conservation

South Dakota NRCS Conservation Practice Standards:

Critical Area Planting (342)

Mulching (484)

Lined Waterway or Outlet (468)

Filter Strip (393)

Subsurface Drain (606)

Underground Outlets (620)

Soil Interpretations in Section II of the SDTG

FOCS, Technical Soils Report